SPECIFICATION FOR INTEGRATED TURBINE AND COMPRESSOR CONTROL SYSTEM (ITCCS) & OVERSPEED DETECTION SYSTEM (ODS)

INSTRUCTIONS TO BIDDERS:

a) Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of RFQ. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected without any further correspondence with the Bidder.

b) Unsolicited requests from bidders for alterations to their already submitted offer will not be permitted. These would not be taken cognizance, and offers will be evaluated without taking into account such requests/correspondence.

c) Any technical features over & above BHEL specification requirements proposed by Bidder will not be given preference for the purpose of evaluation.

d) Bidders shall comply BHEL specifications in total. Incomplete offers will be rejected. In case feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder.

e) Bidders are advised to quote models and makes with proven track record of successful operation. Offers shall include supporting catalogue and published literature [duly highlighting, as appropriate, the offered variant with complete de-codification of the offered models. In case of discrepancy between bidder's offer and published documents, details furnished in published documents will be taken for the purpose of evaluation.

f) In the event of any conflict between these specifications, data sheets, related standards, codes etc. the bidder shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture/procurement of the items in question.

g) Bidder shall submit duly filled deviation format enclosed with this specification along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be rejected. If, there are no deviations, bidder shall submit signed copy of deviation format, mentioning "No Deviations".

h) Bidder shall include all items required for implementation of system as per this specification as a complete package, exclusion of any required item, however not explicitly listed in this specification is not acceptable.

i) Changes if any made by BHEL during technical evaluation on the specification requirements or Bill of material, bidder is requested by the purchase to submit impact price (amount to be reduced or increased to the original offered price) for those changed items only, other items for which there are no technical changes, unit rates shall be maintained as it is.

j) Bidder shall include UNIT prices for all spare items. Bidder may attach separate sheet for the same.

k) Bidder shall include PRICE SCHEDULE format attached with this specification for its technical and commercial bids. Technical bid shall contain the PRICE SCHEDULE with 'QUOTED' against each RFQ item.

l) Sourcing of any raw material or finish good products, any testing and processing on product (e.g. assembly) from China is not allowed except for the following: Electronic cards, modules, power supplies, barriers, isolators, network components etc. may have some internal components / parts manufactured in China, however the supplier shall not be from China.

m) In case of any technical query, bidders may contact the following BHEL engineer before submission of offer:

Name: Ramniwas Sangwa
Designation: Manager
Deptt: TC Engineering
Phone: +91 40 2318 3548
Email: ramsangwa@bhel.in

TABLE OF CONTENTS

Clause No.	Title
1	SCOPE
2	TECHNICAL REQUIREMENTS
3	SYSTEM ENGINEERING
4	ENGINEERING MANUALS
5	COMMISSIONING OF THE SYSTEM
6	SPARES PHILOSOPHY
7	DOCUMENTATION
8	STANDARD WARRANTY (DEFECT LIABILITY PERIOD)
9	EXTENDED WARRANTY
10	POST WARRANTY COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT (PWCAMC)
11	PACKING, MARKING & SHIPPING
12	COMMISSIONING ASSISTANCE
13	TRAINING
14	DEVIATION FORMAT
15	PROVEN TRACK RECORD
16	PROVEN TRACK RECORD FORMAT
17	TENDER EVALUATION CRITERIA
18	LOGISTIC SUPPORT
19	CHECK LIST
20	SYSTEM CONFIGURATION & ARCHITECTURE
21	VARIANT TABLE
22	PRICE SCHEDULE
	RECORD OF REVISIONS

Ref. Doc

1. **SCOPE:**

1.1 This Specification defines the requirement of Integrated Turbine and Compressor Control System (herein called ITCCS through this specification) and Electronic overspeed detection system (ODS) for steam turbine driven compressor train. The scope of bidder shall include Design, Selection, Manufacture, Assembly, Testing (FAT), Packing, Supply, documentation, training and supervision of commissioning & SAT of complete package.

1.2 The ITCCS shall comprise of the following control applications / programs:

1.2.1 Steam Turbine Governing (speed and / or extraction) control.

1.2.2 Compressor control like antisurge, performance, load sharing control etc. (Refer Variant table for number of compressor control application / stages.)

1.2.3 Compressor Performance / Capacity control.

1.2.4 Auxiliary equipment / device monitoring, control, interlock and protection (Refer Variant table for details).

1.2.5 Steam Turbine ODS (Independent of ITCCS hardware as per API-612, 7th ed. and API-670, 5th ed.).

1.2.6 Engineering and operator HMI workstation with 22” monitor with A4 laser printer.

1.2.7 Safe area (IP-55) panel (Rittal TS8 / PS4 series).

1.2.8 Network accessories as per RFQ.

1.3 It is the responsibility of the vendor for engineering of the complete ITCCS & ODS package along with detailed Bill of material and model selection. If there is shortage or mismatch of any items identified at any stage up to commissioning the complete package, vendor shall rectify/replace/supply the items without any commercial or delivery implications.

1.4 The following items are in BHEL / Customer scope:

1.4.1 Field devices.

1.4.2 Cables from/to field / DCS / ESD / EWS & OWS HMI to ITCCS panel.

2. **TECHNICAL REQUIREMENTS:**

2.1 **TECHINICAL REQUIREMENT – ITCCS:**

2.1.1 The ITCCS hardware shall be with DMR / TMR configuration (refer Variant Table). The redundancy shall be on electronic module (CPU, IO etc.) level. For example, redundancy (DMR / TMR) built into single electronic module is not acceptable. In case with vendor offering redundancy built into electronic module (single electronic module is internally Dual / Triple Redundant), vendor shall offer and supply redundant electronic modules. CPU redundancy shall be on electronic module level only. Refer attached System architecture for detail.

2.1.2 ITCCS cards shall be Hot Swap type i.e. it shall be possible to program, re-program, remove from rack and insert into rack with system shutdown. The ITCCS electronic cards including CPU, IO, Communication, PS shall be on-line configurable and on-line repairable.

2.1.3 Complete ITCCS hardware shall be SIL-3 certified as per IEC61508 / IEC61511.

2.1.4 The ITCCS loop scan / response time (total time to read input, processing time and output) shall be as per the machine dynamics and safety and shall be maximum 40 milliseconds. Any faster response required based on machine dynamics shall be considered by vendor. The input sampling interval shall be as per machine dynamics within the controller response time as above. The processor cycle time shall be considered to meet the overall response time.

2.1.5 The response / scan time demonstrated during FAT by measuring the time delay between change in any analog input and corresponding change in analog output. This is applicable for governing and antisurge / performance / load sharing control applications inside ITCCS.

2.1.6 ITCCS panel shall be located in Rack room (RR) and the following operator interfaces shall be considered.

a) One EWS & OWS HMI workstation with 21" / 22" monitor (make model will be informed during detail engineering to match with other monitors). The workstation shall be used as engineering, configuration and operator station, accordingly development, logic modification and run time licensed software's shall be provided. The EWS & OWS HMI workstation shall have following minimum hardware configuration:
   i. Make: DELL / HP.
   ii. HDD ≥ 1 TB, RAID 1 configuration.
   iii. CPU: Intel Xeon or better.
   iv. RAM ≥ 8 GB
   v. OS: Windows latest version with Microsoft office.
   vi. Ethernet: Dual Channel 10 / 100 Ethernet card.

b) The workstation shall be used for following functions:
   i. Programming, Engineering, configuration of ITCCS.
   ii. Loading / Unloading / backup of ITCCS program.
   iii. HMI Graphic Screens development and modification.
   iv. Trends, Alarm Historian & SOE.
   v. Capability to transfer / export trends, Historian data / SOE to MS Excel.

c) The software licenses shall not be time bound or limited to specific period of use (like valid for 1 year etc.). The software license shall not expire after a certain period.

d) The HMI Workstation shall be supplied with antivirus software, valid for at least 3 years from date of activation.

e) The complete software backup image of As-Shipped workstation shall be supplied in a USB.

f) A second software backup image of the As-Commissioned HMI workstation shall be created after commissioning and a copy of the same shall be submitted to BHEL in a USB.

g) Vendor to supply program loader (laptop, if specified in RFQ) along with necessary maintenance software's (licensed software's) for application program engineering, modification, uploading/ unloading in the ITCC.

h) In case laptop is not specified in RFQ, vendor shall supply necessary maintenance software's (licensed software's) for application program engineering, modification, uploading/ unloading the ITCCS. In this case, the laptop shall be supplied by BHEL.

i) Connecting cable to ITCCS & ODS system shall be provided. Licensed version of latest antivirus with 3-year validity shall be provided in all Laptops and EWS & OWS workstation. The Antivirus shall be activated during commissioning.

j) Vendor shall supply two licensed copies of all ITCCS & ODS software in CD / DVD / USB with passwords / keys to access the software.

k) The ITCCS program / configuration shall be stored in non-volatile memory or battery back-up for configuration shall be provided (minimum 72 hours) in case of volatile memory along with battery drain indication.

2.1.7 **The steam turbine governing (GOV) application inside ITCCS shall have following minimum features:**

a) The GOV shall be API 670 & 612 compliant.
b) GOV shall accept input from 3 speed sensors, the pole wheel details will be furnished during detailed engineering.
c) It shall be possible to program the GOV to operate the steam turbine from zero speed to rated speed with ramp rates, idle speeds, critical speeds for Hot, Cold and Warm conditions as per the startup curves to be furnished during detailed engineering.
d) The governing valve characteristics shall be programmed in the GOV for linearization.
e) The GOV shall be capable of operating in Auto, semi auto and manual modes.
f) The GOV shall accept external 4-20 mA signal from DCS or Local as a manual speed / load setpoint to governor. The governor shall have bumpless transfer for auto / manual selection or local / remote selection. The auto/manual selection and local/ remote selection facility shall be configured in governor and available on the HMI.
g) HMI shall include features like assignable speed range, adjustable speed set point, remote speed set point input, digital speed indication, adjustable speed ramp, override for testing the external Overspeed trip system etc.

2.1.8 **The compressor control application inside ITCCS shall have following minimum features:**

a) Compressor Control mean Compressor Antisurge, Performance, Load sharing etc. In some cases, Compressor Control applications / controllers like Performance, Load sharing etc. may not be applicable. Please refer the Variant Table for Project Specific Controllers / Applications.
b) Each antisurge control application shall have minimum five analog inputs (or six if two flow transmitters are used based on flow range). The output shall be to single antisurge control valve (sometime two outputs to two ASC valves if valve size is big).
c) In addition to above, there shall be provision for manual override (open command) to ASC valve through 4-20 mA signal from DCS.
d) Sufficient number of digital IO shall be considered for transmitter fault, trip, purge, load / unload, run / stop etc.
e) The antisurge algorithm shall be based on invariant coordinate system. Vendor shall design the antisurge algorithm such that it is immune to changes in gas properties (like change in mol. Weight, pressure, temperature etc.)
f) Compressor speed, if required shall be connected from GOV application.
g) Project Specific data like Process P&ID, Isometrics, Instrument datasheets shall be provided during detail engineering; however, the number of Compressor Control applications / controllers (Antisurge, Performance, Load sharing etc.) shall be as specified in Enquiry.
h) The input and output IOs for Performance / load sharing etc. if applicable, shall be decided as per the project requirements. There shall be provision for giving external control setpoints from DCS for performance / load sharing control. Vendor to indicate and include the same.

2.1.9 **The auxiliary control application inside ITCCS shall have following minimum features:**

a) The auxiliary device control application shall be independent of governing and compressor control application. It shall not stop function if main steam turbine governing and compressor control application are not running / tripped.

b) Lube oil pump drive turbine (API-611) speed control (2 speed inputs and analog outputs to governing valve and DCS). The ODS based on 3 speed inputs for this steam turbine shall be through trip amplifiers. The three relay outputs from trip amplifiers shall be 2oo3 voted in ITCCS and DO shall be provided to trip the lube oil steam turbine. The same is also applicable if the steam turbine is used for any other pump like condensate pump.

2.2 **TECHINICAL REQUIREMENT– Electronic overspeed detection system (ODS):**

2.2.1 The Electronic ODS shall be API 670 & 612 compliant and SIL-3 certified as per IEC61508 / IEC61511.

2.2.2 The Electronic ODS shall be independent of the ITCCS. Separate electrical over speed trip circuits consisting of speed sensors and logic devices shall be used to provide in 2oo3 voting configuration.

2.2.3 The Electronic ODS shall accept input from 3 speed sensors, the pole wheel details will be furnished during detailed engineering.

2.2.4 The Electronic ODS shall be assembled in the ITCCS panel.

2.2.5 The Electronic ODS shall have online testing / repair facility and internal function generator and fully redundant power supplies.

2.2.6 The Electronic ODS shall sense an Overspeed event and change the state of its output relays within 40 milliseconds maximum.

2.2.7 Program loader laptop / workstation (as specified in RFQ) shall be loaded with software for program loading / unloading and settings configuration of ODS.

2.3 **TECHINICAL REQUIREMENT – GENERAL:**

2.3.1 ITCCS & ODS electronic modules shall be conformal coated to G3 environment as per ISA.

2.3.2 The analog input and output signals shall be 24VDC, 4-20mA, SMART HART, 2 wire and powered from the ITCCS through barriers / isolators. The Governing IH converter is high power device and may be 4- wire, powered through separate 24VDC.

2.3.3 If specified as per Variant table, the analog IO shall be HART capable / enabled. Serial Connectivity shall be provided to Purchaser HART management system. In case IO cards are not HART capable, HART connection shall be provided through HART multiplexer in conjunction with barriers / isolators.

2.3.4 The controller shall monitor each transmitter input signal for high and low values. Alarm limits shall be set at 95% increasing and 5% decreasing signals. When a transmitter input signal exceeds the alarm limit, a relay will de-energise to actuate a command “transmitter out of range” alarm (alarm by others) in the control center. The controller output signal shall de-energise a relay at 95% decreasing value to actuate “Controller operating” alarm (by others) in the control room.

2.3.5 The controller shall monitor its output and initiate an alarm if output failure is detected.

2.3.6 The controller shall be designed with a fail-safe mode to prevent a process upset caused by a transmitter or input failure. The controller vendor shall specify the fail-safe mode required for each specific installation.

2.3.7 Two feeders of UPS power supply shall be provided at ITCCS panel by purchaser, all other power supplies for ITCCS, ODS, HMI, separate & independent 24VDC-5A power supply for I/H converters (Redundant), power supply for Laptop, Printer, barriers, isolators etc. shall be generated / provided by the vendor from ITCCS panel.

2.3.8 The workstation, Laptop and printer shall be suitable for power supply range of 90 to 270 V ac 50/60 Hz. Power cable and other accessories for Laptop and printer shall be supplied by the vendor.

2.3.9 For Speed measurement, Magnetic Pickups (MPU, Explosion proof type) or Proximity sensors (intrinsic safe) are required. The same shall be suitable for hazardous area classification for IEC Zone-1 & Zone-2 Group IIC, Temperature class T3.

2.3.10 All inputs and outputs from hazardous area shall be provided with barriers and from safe area shall be provided with isolators / relays.

2.3.11 The vendor shall design and provide earthing as per the protecting earthing system according to IEC rules.

2.3.12 It is vendor's responsibility to supply a system, which functionally meets all the requirements of this specification. Any item not supplied but required to meet the specification requirements, during the execution of the order or during commissioning to meet the proper functioning of the system, shall be supplied by the vendor at no extra delivery and no extra price.

2.3.13 Communication cables shall be supplied with connectors at both ends. Necessary additional SIO modules as required shall be supplied and assembled in the cabinet by the vendor for achieving the dual redundant communication to DCS.

2.3.14 It shall be possible to operate, program, and diagnose the control system faults from the HMI.

2.4 **TECHINICAL REQUIREMENT – INSPECTION & TESTING:**

2.4.1 Bidder to furnish the QA plan & FAT procedure along with the data sheets of all the equipment in line with attached ITP for approval after placement of order.

2.4.2 The controllers / fully assembled system (if applicable) shall be tested in an integral manner by simulation. Customer / Consultant / BHEL and/ or BHEL authorized representatives shall inspect the system at supplier works during factory acceptance test (FAT).

2.4.3 The latest certificates for use in hazardous areas shall be furnished for instruments / equipment (if applicable) by the vendor as specified below:

- Certificates from statutory authorities like BASEFA, FM, PTB, UL and LCIE etc. for items of foreign origin and from CIMFR etc. for items of Indian origin.
- Approval certificates from CCE (Chief Controller of Explosives)/ PESO for items to be installed Hazardous area in India, irrespective of country of origin and the same is mandatory. In case CCE certificate is not available for any item at the time of offer, vendor shall confirm that the certificate shall be furnished during detailed engineering and before dispatch.
- Approval certificate from BIS (Bureau of Indian Standards) for all flameproof instruments of Indian origin.

2.5 **TECHINICAL REQUIREMENT – IO SUMMARY:**

2.5.1 ITCCS IOs for Governing and Compressor control applications are as follows. This IO Count does not include IO's for Overspeed protection system and Auxiliary control loops.

Sl. No	Description	IO Count	Remarks
i	Speed Input	4	Suitable for Magnetic or proximity sensors
ii	Digital Input	24	Programmable
iii	Digital Output	12	Programmable
iv	Analog Input	32	Programmable
v	Analog Output	12	Programmable

2.5.2 Auxiliary control loop IO count:

Sl. No	Description	IO Count	Remarks
i	Speed Input	2+3*	*three speed sensors connected to trip amplifier.
ii	Digital Input	-	Used from ITCCS IO
iii	Digital Output	-	Used from ITCCS IO
iv	Analog Input	-	Used from ITCCS IO
v	Analog Output	-	Used from ITCCS IO

2.5.3 The above I/O's do not include the no. of I/O's required redundancy module & auto testing facility.

2.5.4 The above indicated IO count includes installed, unused spare IOs. Vendor to note that 20% installed IO shall be left UNUSED after IO allocation. In case above listed IO count is not sufficient, vendor to increase the IO count accordingly.

2.5.5 All IOs shall be wired to terminal through barriers / isolators / relays.

2.6 **TECHINICAL REQUIREMENT – COMMUNICATIONS:**

2.6.1 Communication with DCS: ITCCS shall be interfaced with the customer's DCS via dual redundant RS485 MODBUS RTU or Modbus TCP (to be finalized during detail engineering) link. Vendor shall ensure that each controller shall be provided with TWO number of communication ports for above.

2.6.2 Communication with EWS / OWS HMI workstation: Redundant communication ports, preferably ethernet shall be provided on ITCCS. Vendor shall provide all communication hardware & software and other networking accessories like redundant Ethernet Switch for redundant communication network.

2.6.3 In some cases, if the cable distance between ITCCS and workstation is very large, communication shall be on fiber optic network. Vendor shall provide TWO sets of DIN rail mount type redundant Fiber Optic Converters with LIU and patch cords along with redundant 24VDC power supply.

2.6.4 Ethernet cables from FOC to ITCCS / FOC to workstation shall be supplied by vendor.

2.6.5 Electronic ODS shall be interfaced with the customer's DCS via dual redundant RS485 MODBUS RTU link.

2.6.6 Vendor shall furnish the communication network schematic indicating all the hardware components along with the offer.

2.7 **TECHNICAL REQUIREMENTS-SYSTEM PANEL:**

2.7.1 ITCCS shall be supplied in fully assembled, wired and factory tested panel. The specifications for panel are as follows:

Sl. No.	Requirement	Description
1	Environment	a. Ambient Temp: 1-50℃ b. Humidity: 10-100% c. Hazardous Area classification: NA. Field Instruments are located in Hazardous area IEC zone-1, IIC. d. Mounting location: Indoor, Air Conditioned. e. Ingress protection: IP55 for Panel.
2	Panel Construction	a. Make: Rittal TS8 series or Equivalent. Equivalent panel shall be similar to Rittal TS8 series. b. Door: front (with glass window) & rear c. MOC: CRCA d. Sheet thickness: i. Door: 2.0 mm ii. Sides: 1.5 mm iii. Gland plate: 3.00mm iv. Mounting plate: 3.0 mm e. Structure: As per make / model listed above. f. Base frame: Yes, 100 mm. g. Anti-vibration pads: Yes h. Lifting eyebolts: Yes, removable type i. Screws, door handles, hinges and other non-painted metallic parts: Stainless Steel j. Dimensions: 800mm(W) x 2100mm(H) x 800mm(D) k. Cable entry: bottom l. Document pocket: Yes m. Laptop shelf: Yes
3	Painting	a. Pre-treatment: 7-tank dip, de-rusting, degreasing, phosphatizing, passivation, sand blasting, grinding, chemical cleaning & surface finish. b. Primer: Two coats c. External colour: RAL7035. d. Base channel: Black
4	Major Equipment / rack mounting from bottom	~1300 mm and above
5	Main Name plate	a. Material: Acrylic (engraved) b. Letter: White c. Background: Black d. Fastening: Screwed
6	External Equipment Tag plate	a. Material: Acrylic (engraved) b. Letter: White c. Background: Black d. Fastening: Screwed
7	Instrument Tag Plate / Label	a. Material: Acrylic (engraved) b. Letter: White c. Background: Black d. Fastening: Screwed
8	Electrical	a) Panel wiring: FR PVC insulated 660 / 1100V grade, single core multi-strand, copper conductor. b) Conductor Size: 1.0 sq. mm for signal & 2.5 sq. mm for power. Pre-Fab cables as per manufacturer standard. c) Wiring colour code: provided during detail engineering. d) Ferrules: Cross ferruling with White / Yellow silicon type, printed. e) Terminals: screw less, clamp-on type (Wago, Phoenix, Weidmuller)

Sl. No.	Requirement	Description
		f) Earth / Grounding: Yes, signal and power earth with Earth Bus Bar (6mm thick) and lugs. g) Incoming power: i. UPS: 110 or 240VAC-Redundant Feeder (provided during detail engineering) ii. Non-UPS: 240VAC-Single Feeder
9	Cable entry	Through MCT, make Roxtec.
10	Exhaust fans and louvers	Yes, back door / top mounted and louvers.
11	Installed Spare electricals	20% for MCB, Power Supply, Power and Signal Terminals, Relays, Barriers etc.
12	Interposing Relays	Yes, for DI & DO
13	Isolators / Barriers	Yes, for AI / AO
14	Surge Protector	Yes, for Power Supply and Communication

3. SYSTEM ENGINEERING

3.1 The assigned Systems Engineer (SE) provides the system engineering for the project to assure that the control system is designed to meet the customer specifications. This service includes generation of the controller wiring drawings and control system diagrams (CSD's), the development and implementation of the control logic with Initial Controller Configuration Parameter Sets, any special recommendations on the control system components, and system programming and testing. A design audit of the completed control solution shall be made before shipment. This takes the form of a presentation by the SE to the design audit team, which reviews all aspects of the engineered solution.

3.2 SE shall review the control system design with the customer to ensure compatibility between the control system and the application.

3.3 SE shall review the control system design with the customer to ensure compatibility between the control system and the application.

3.4 Transmitters, flow measuring devices and antisurge valves associated with Antisurge control, Performance or Load sharing Control etc. are evaluated for proper location and sizing.

3.5 The system engineering service shall include the following for each compressor control application, but not limited to the following:

i. Preparation of Design Specifications.
ii. Vetting of governing scheme and governing valve characterization.
iii. Vetting of Antisurge Valve Sizing, Suction Throttle Valve Sizing etc.
iv. Number of Unique Antisurge Valves – As (as per ASC Loops specified in variant Table).
v. Number of Compressor Maps to be analyzed per Valve
vi. Flow Measuring Device Calculations
vii. Number of Unique Flow Measurement Devices (FMD's)
viii. Number of Compressor Maps to be analyzed per FMD
ix. Controller Configuration.
x. Transmitter Range Specification
xi. Preparation of Drawings.
xii. Mod Bus Address mapping list for interfacing controller with DCS
xiii. System / Process configuration for Performance / Load sharing (if applicable)

4. **ENGINEERING MANUALS**

4.1 The design and specifications shall be formally documented in the Engineering Manuals and provided in three hard copies and one CD. This includes:

i. Control system diagrams
ii. A wiring and jumper list
iii. A system description
iv. Controller dimensional drawings
v. Panel structural and layout drawings
vi. A bill of materials
vii. Controller instruction manuals
viii. Initial controller configuration parameters (refer Note)

4.2 Note: 'Initial Controller Configuration Parameter Sets' are calculated and prepared using project-specific data for channel assignments and functionality where possible. Gains, biases and control responses are necessarily maintained at conservative levels for safety reasons during initial start.

5. **COMMISSIONING OF THE SYSTEM**

5.1 The Control system representative from the nearest location from the site shall supervise the erection, Commissioning, configuration and tuning of the controller & accessories supplied by vendor.

5.2 The Field Engineer shall be responsible on site for system integration and commissioning, to troubleshoot and correct any connectivity issues and to tune the system in response to actual system dynamics.

5.3 Vendor shall optimize the overall system with respect to appropriate integration and interface with customer's DCS etc.

6. **SPARES PHILOSOPHY:**

6.1 The system shall meet the following spare philosophy. This philosophy shall be applicable for items like IO's, barriers, isolators, relays, terminals, lamps, push buttons etc.

6.2 **SPARES PHILOSOPHY:** Vendor shall include following spares in their scope of supply:

a) **INSTALLED ENGINEERING SPARES (part of main system):** Installed engineering spares shall be provided in each sub-system for each type of electronic module to enhance the specified system functional requirements by 20%. The basis of offering installed engineering spares shall include:

i. For a system with conventional and / or smart analog input / output, discrete (contact) input / output, 20% spare input / output of each type shall be considered for calculating I/O modules and all other related accessories.
ii. For all serial input / outputs to the system, 20% spare serial I/0 ports of each type of serial input / output shall be provided.
iii. 20% spare accessories like relays, switches, lamps, fuses, circuit breakers, barriers, isolators, terminals etc.
iv. The engineering spares shall be wired up to the field cable interface and shall be in ready-to-operate condition when field cable is connected to spare assigned terminals.
v. Spare pairs of the incoming cables shall be terminated on spare terminals in the marshaling / barrier cabinets as applicable.
vi. The system shall be fully engineered considering 20% installed engineering spares including processor loading.

b) **SPARE SPACE REQUIREMENT:** In addition to installed engineering spares specified in ***Installed Engineering Spares*** of this specification, the system shall be provided with following spare space:

i. I/O racks of programmable logic controller shall have 20% usable spare space for installing additional I/O cards of each type in future. However internal wiring for the same shall be connected up to the I/O terminals.
ii. Processor system of programmable logic controller shall have capability to execute additional 20% logics.
iii. Each operator console shall contain 20% usable spare group and related display capability in addition to as specified in ***Installed Engineering Spares*** of this specification.
iv. The system shall have capability to extend its historical trending, logging and user's memory by 20% to meet future expansion with/without adding additional memory modules.
v. The communication sub-system shall have sufficient capacity to handle additional data contributed by addition of 20% I/O over and above installed engineering spares.
vi. Usable spare space in panels and cabinets to install 10% spare hardwired items like relays, switches, lamps, fuses, circuit breakers, barriers, isolators, terminals, and panel mounted instrument etc. in future.

c) SPARE MEMORY REQUIREMENT:

i. The system shall be provided with a minimum of 40% spare memory capacity, as required for application program and data base to meet specified functional requirements.
ii. It shall be possible to extend the memory by at least 20% over and above the actual requirement at a later date.

d) SPARE SOFTWARE CAPABILITY:

i. Sufficient additional software capacity shall be available in the system to take care of spares requirement as specified in ***Installed Engineering Spares*** and ***Spare Space Requirement*** of this specification to meet all functional requirements of this specification.
ii. Unless specifically indicated otherwise, the offered system shall have software licenses to cover all the tag numbers indicated in the material requisition, including installed engineering spares and spare space indicated in this specification.

e) MANDATORY SPARES:

i. Mandatory spares shall be ware-house spares and shall be supplied as loose items. Refer Variant table for quantity and details.
ii. Spare modules for all types of CPU cards, IO cards, Communication cards, power supplies, termination assemblies, pre-fab cables, signal conditioners, barriers, etc.
iii. Spare networking components like Ethernet switches, fiber optic converters, surge protection devices, patch cords, LIU etc.
iv. Spare power line filters, lamps, fuses (100%) and circuit breakers, Relay, Barrier, 24V DC PS, Fan, Filter etc.

f) COMMISSIONING & CONSUMABLE SPARES:

i. Vendor shall be responsible to supply any spares which are found necessary to replace failed modules, failed sub-systems, or corrupted / faulty software while performing pre-commissioning and commissioning activities.
ii. Against commissioning spares, a complement of commissioning spares such as CPU cards, IO cards, Power supplies, Isolators, Barriers, Termination assemblies, pre-fab cables, fuses, connectors, EEPROMs and any other item deemed necessary considering that the failure of any component of the system should not delay the commissioning of the system.
iii. Consumable spares like fuses (1 dozen, each type), printer head 02 nos, paper rims: 10.

Ref. Doc

7. DOCUMENTATION:

7.1 Documentation shall be in three steps, during offer submission as response to BHEL RFQ, drawing approval stage, and during delivery of items stage (as-built). All the documents shall be preferably in A4 size (Drawings in Auto-CAD, and documentation in A4 Size PDF) shall be used for submission. The documentation aesthetics shall be in line with international standards. Incomplete data, without title blocks, name of the item, document number, revision number, page number etc. will not be acceptable. Bidder shall be responsible for creating, making and arranging complete documentation as per BHEL requirements at all stages.

7.2 During Technical offer submission: Two copies of following

- Filled up check list.
- Catalogues of ITCCS, ODS and other hardware.
- Configuration diagram of system
- Details of Software.
- Write-up of System.
- Hardware (rack) configuration & Communication interface diagram.
- Deviation list as per “deviation format" if any.
- Compliance certificate (duly signed & stamped copy of complete specification).
- Un-priced price schedule.
- PTR (mandatory) for all the items.
- Filled in Certificate of logistics support as per format.

7.3 Vendor shall visit BHEL office within one week of PO/LOI to collect the project specific information (Tag no’s, services, range, etc.) for engineering their drawings/documents.

7.4 During drawing approval after PO placement:

- Control system description.
- Control system diagram / Architecture.
- HMI graphics
- Antisurge control valve sizing verification / recommendation.
- IO List / Pressure / Flow / Temperature instrument range recommendation.
- Recommendation regarding items in the antisurge loop (Piping length etc.)
- General arrangement, BOM and Wiring Diagram
- MODBUS address list for serial communication
- Quality plan & FAT Procedure.
- Type Test & Statutory certificates.

7.5 It is the responsibility of the vendor to review the documents for total compliance with all the BHEL specifications furnished with the inquiry before submitting to BHEL.

7.6 The data sheets will be forwarded by BHEL to Customer/Consultant for approval, comments if any from Customer/Consultant shall be clarified and revise the data sheets if required by the vendor in line with BHEL/EIL specifications furnished with the inquiry.

7.7 Vendor has to attend technical meeting with Customer/Consultant along with BHEL if required for technical discussions and obtaining approval of documents for the package items.

7.8 Along with material, final documentation in 6 Copies shall be sent to project site and two numbers of soft copies in CD with the following listed documents. However, one advance copy shall be handed over to BHEL- Engineering for approval before dispatching multiple sets of 6 copies to the project site.

- Packing list.
- All the documents submitted during drawing approval after incorporating FAT corrections if any.

- Inspection reports
- Photo copies of BHEL Approved documents
- Test certificates
- Warrantee certificates
- Operation & Maintenance manuals
- Commissioning procedure.

7.9 It is Vendors responsibility for obtaining approvals on drawings/documents from BHEL/Customer within time frame and dispatch material in time to project site office as per purchase order delivery schedule. Further vendor requests for any clarifications or approvals for delivery extensions etc. are not entertained at any stage.

7.10 Within 15 days after commissioning:

- Final reports giving details of commissioning data, its analysis and recommendations, if any.
- Vendor shall supply the portion of system engineering document, which requires updating as per commissioning data, and 6 copies & 2 CD's of it shall be furnished.

7.11 Vendor shall provide the re-packing instructions after the testing is completed in BHEL works.

7.12 The following documents shall be provided to vendor after PO placement. Vendor to check and inform if any additional data/ document is required and specify the same in its offer.

i. Turbine & Compressor Datasheet.
ii. Compressor Performance Maps.
iii. Turbine & Compressor Process P&ID.
iv. Turbine Tooth wheel drawing.
v. Governing valve characteristics curve.
vi. Compressor Suction (or discharge) Flow Element Datasheet.
vii. Antisurge Control Valve Datasheet.
viii. Suction Throttle Valve Datasheet (if applicable).
ix. Performance Controller Objective / Variable.

8. STANDARD WARRANTY (DEFECT LIABILITY PERIOD):

8.1 The vendor shall guarantee trouble free performance of the supplied systems and work during this warranty period. In case of any defect or non-performance of the system or a component during this guarantee period, the same shall be replaced/ rectified free of cost. Any such replacement / repair shall to be carried out within 72 hours of reporting the issue to the vendor. In this regard, vendor is advised to consider periodic maintenance checks, as required in order to ensure 100% availability / trouble free performance.

8.2 During warranty period, vendor shall supply all spares and consumables for ITCCS & ODS package items. vendor shall provide warranty maintenance services and supply of spares for maintaining an uptime of 98% for each system. Any fault shall be attended within 72 hrs.

8.3 All equipment / instrument supplied shall be guaranteed upto 31st August 2023 is proved under normal operating conditions to be of inadequate design or of defective material or of poor workmanship. In such event the guarantee period for the particular equipment / instrument shall be another 12 months from the date of acceptance by PURCHASER / OWNER of such replaced / repaired equipment / instrument. However, this extended guarantee period shall have an upper limit till 31st August 2024.

9. EXTENDED WARRANTY:

9.1 In addition to standard warranty specified above, extended warranty of 2 years for ITCCS & ODS package shall be considered. The extended warranty shall start after expiry of standard warranty (defect liability period) indicated above.

9.2 The terms and condition of extended warranty shall be same as those for standard warranty (defect liability period).

10. **POST WARRANTY COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT (PWCAMC, if specified in RFQ):**

10.1 Comprehensive post warranty annual maintenance contract for 3 years duration shall be provided for Package. PWCAMC shall be executed after expiry of extended warranty.

10.2 Vendor shall propose 3 year's post warranty maintenance contract & contract shall exclusively mention the service to be provided, methodology, scope of work, and Vendor's responsibility with year wise break-up.

10.3 In the event of any malfunction of the system hardware / system software, experienced service engineer shall be made available at site within 24 hours on the receipt of such Information from OWNER.

10.4 The contract shall include supply of maintenance spares, tools & tackles as required, Travel, boarding & lodging of service engineer. The quote shall be made year wise upto 3 Years.

10.5 Contract shall include on site stock & shall give cost of each item after expiry of 3 Years AMC with escalation formula.

10.6 The service under Post Warranty Maintenance Contract including supply of spare parts and services shall broadly encompass:

- Preventive maintenance
- Periodic maintenance
- Emergency service
- Software support

10.7 Preventive maintenance: Once in a year, involving complete overhaul of the system, inspection of hardware and software, fault prediction, inspection of power supply quality, environmental and operating condition checks, calibration checks, major repairs/replacements and detailed reporting.

10.8 Periodic maintenance: Site visits, minimum four to six times in a year, inspection of general healthiness of the system, study and advice on daily maintenance, inspection of H/W & S/W. if any problem is reported, running of test programs, on-line servicing and solving reported problems.

10.9 Checks shall be conducted on running system i.e. (a) On-line sub-systems (b) Power supply checks (c) Others vendor to mention.

10.10 Software maintenance: Maintain existing software to improve and utilize existing application and improve performance of the system. Minor modification of the software shall also be covered under this scope.

10.11 Emergency service: Any failure shall be on system suppliers' account. The Engineer must report at site within 24 hrs of report of failure, with necessary spares. The system must be brought back within 24 hours after reporting at site.

10.12 NOTE-1. Vendor to note that while carrying out the Post Warranty Maintenance Contract activities OWNER'S engineers may associate with system engineers. On job training of these associated engineers shall be covered under this scope.

10.13 Note-2. All financial aspects of the Post Warranty Maintenance Contract must be listed clearly by the Vendor.

10.14 Vendor shall stock 1 no of each type of card / module and any other additional spares recommended, at owner site, and these shall not be part of the mandatory spares. Vendor can use these spares during the AMC. The spares used shall be replaced by vendor within 7 days with no cost to Owner. Vendor shall maintain a record of all faults during the PWCAMC.

10.15 Purchase order for PWCAMC shall be placed before expiry of extended warranty as per commercial terms and conditions).

11. **PACKING, MARKING & SHIPPING:**

11.1 PACKING:

i. All the items shall be packed in very good quality packing; the packing shall be such that the items should not be damaged during loading, unloading and transportation, the packing shall be suitable for 6 months of outdoor storage from the date of shipment.

ii. The operation and maintenance manuals of all the items 2 copies shall be included in the packing.

iii. One copy of the packing list shall be fixed on the packing with suitable protection to with stand loading, unloading, transportation and rain.

iv. Adequate amount of silica gel or equivalent shall be provided in each box before dispatch for the removal of moisture till installation.

v. All safety instructions for storage and handling shall be indicated on external surface of each box.

11.2 PACKING LIST:

i. Detailed packing list with description, quantity, tag nos, make and model no. etc. including the list of O&M manuals shall be prepared by vendor and submitted to BHEL before dispatch.

ii. As this system shall be used in BHEL shop for machine testing, the minimum items required for testing shall be packed separately. Other items, which are not required for testing, shall be packed and marked separately to dispatch directly to site. Vendor shall identify this list in their offer.

iii. All the items shall be shipped in a single shipment.

iv. It is the responsibility of the vendor to check that all the items are dispatched along all the accessories i.e. Cable glands / MCT, Mounting brackets, adapters etc. Queries if any received from site regarding the ITCCS & ODS package items, shall be clarified by vendor immediately, malfunction or defects of any items reported from site within the guarantee period shall be replaced at site immediately without any commercial or delivery implications.

v. Bidder to consider and include charges for one visit to site as part of the main package as and when informed by BHEL to resolve issues if any reported from site regarding material discrepancy of the ITCCS & ODS package items.

11.3 Each device shall be identified with the following information as a minimum.

i. OEM name or identity

ii. Manufacturer's model and /or serial number

iii. instrument range

iv. Tag no.

The above information shall be in a permanent form on a stainless-steel nameplate and permanently attached to the device/equipment.

12. **PRE-COMMISSIONING & COMMISSIONING ASSISTANCE:**

Pre-Commissioning & Commissioning assistance at site & BHEL works during turbine testing for the above equipment shall be provided by vendor (Lump sum). A total period of 5 working days for pre-commissioning, excluding travel time and 2 visits shall be considered. A total period of 12 working days for commissioning, excluding travel time and 3 visits shall be considered. The offer shall be inclusive of Travel, Boarding & Lodging and local conveyance during the visit. BHEL may decide to place order for additional number of days & visits (refer actual no of days / number of visits in Price Schedule / RFQ).

13. **TRAINING (If specified in RFQ):**

13.1 The training shall include configuration, operation and maintenance of the ITCCS and ODS package. The training shall be conducted at site. All requisite training material for the said training shall be provided by the vendor during the training.

13.2 Training of 5 engineers for 5 days excluding travel time at site and one visit inclusive of Travel, Boarding, Lodging and local conveyance shall be considered.

14. **DEVIATION FORMAT:**

14.1 Bidder shall submit duly filled deviation format (as given below) along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be considered for rejection. If, there are no deviations, bidder shall submit signed copy of this format, mentioning "No Deviations".

Sl.No	Clause No. of Spec	Deviation	Reason for deviation	Deviation category	
				Product/design limitation	Optimization
1					
2					

15. **PROVEN TRACK RECORD**

The system being offered as per specification shall have well proven performance record of operating satisfactorily in two similar units in a hydrocarbon processing industry for a minimum of 8000 running Hours. The above criteria shall be applicable to main equipment, sub- components as well as brought out items if any. Prototype equipment / instruments or instrument under phase out cycle shall not be offered or supplied. Bidder shall submit necessary supporting documents / past users confirmation supporting to above PTR requirements along with technical offer. Bidder to furnish the PTR details as per clause 16 and the Certificate for logistics support as per clause 18 along with the offer.

16. **PROVEN TRACK RECORD FORMAT**

a) Name of the Bidder
b) Whether manufacturer & supplier:
c) Whether System Integrator & Supplier:
d) Name of Packager:

Sl. No	PTR Requirement	Ref-1	Ref-2	Ref-3	Ref-4
1	Description of the items offered				
2	Description of item as manufactured & Supplied/ engineered (identify bidder's scope of work)				
3	Purchaser's name, address, Tel no, Fax no, email and contact person				
4	Date of order placed				
5	Contractual completion date				
6	Actual completion date/ month & year of commissioning				
7	Reasons of delay if any				
8	Approved value of order				
9	Details of major break down till date.				

17. **TENDER EVALUATION CRITERIA**

17.1 The total price for the complete package i.e. Main System, Mandatory spares, commissioning charges and training, warranty, extended warranty & PWAMC shall be considered for L1 evaluation.

17.2 Duly signed & stamped un-priced price schedule and unit prices shall be submitted along with technical offer by bidder as a token of concurrence that all items are quoted without which the offer will not be evaluated. For unpriced bid bidder to fill 'Quoted' for each item and submit PRICE SCHEDULE with technical bid.

18. **LOGISTIC SUPPORT**

i. Vendor shall ensure and provide the following information/ details along with the offer.

i. Local service facilities in India is available or not from the vendor?
ii. If not available, where the vendors approved service facility presently located nearest to India.
iii. Instruments / System shall be user serviceable.
iv. User reference list
v. When was quoted model introduced in the market?

ii. **Certificate for logistics support (by Principal)**

(To be signed by Principal's corporate level signatory on company's letterhead and submitted along with the offer)

I, on behalf of M/s …… confirm that the …… quoted by M/s …… for <by BHEL, Later> Gas Compressor of <by BHEL, Later> Project shall continue to be supported by us. The quoted item shall not be withdrawn from Indian market in next five (5) years from the date of placement of order as a matter of our corporate policy.

I further confirm that in case of placement of order by M/s BHEL on M/s …… we shall continue to support M/s BHEL / END USER in providing back-up engineering, maintenance support and spare part to M/s BHEL / END USER for a period of 10 years from the date of expiry of warranty.

SIGNATURE WITH SEAL
AUTHORIZED, SENIOR MANAGEMENT LEVEL

iii. **Certificate for Logistics Support (by Vendor)**

(To be signed by Vendor's corporate level signatory on company's letterhead and submitted along with the offer)

I, on behalf of M/s …… confirm that the …… quoted by M/s …… for <by BHEL, Later> Project shall continue to be supported by us and our principal(s). The quoted item shall not be withdrawn from Indian market in next five (5) years from the date of placement of order as a matter of our corporate policy as supported by attached certificate from our principal(s) M/s ……

I further confirm that in case of placement of order by M/s BHEL on us, we shall continue to support M/s BHEL / END USER in providing back-up engineering, maintenance support and spare part to M/s BHEL / END USER for a period of 10 years from the date of expiry of warranty.

SIGNATURE WITH SEAL
AUTHORIZED, SENIOR MANAGEMENT LEVEL SIGNATORY

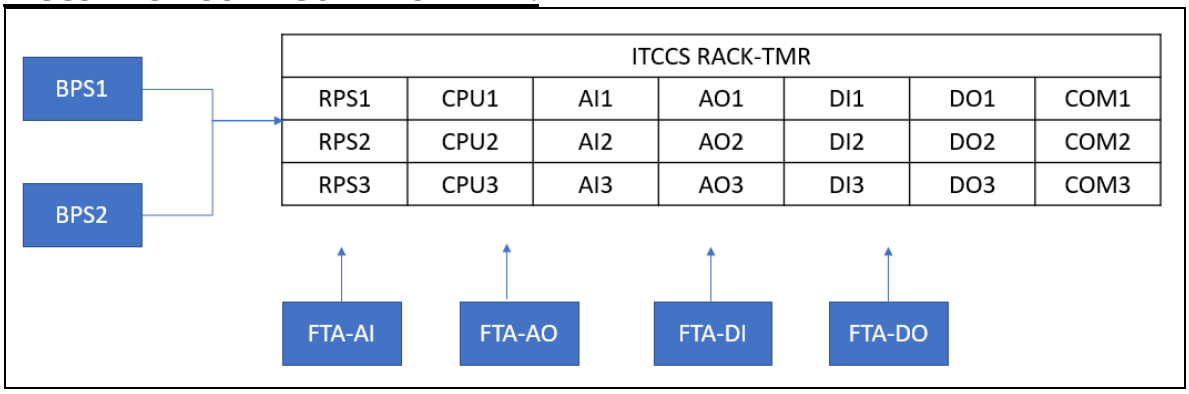
19. **CHECK LIST:**
(TO BE FILLED BY BIDDER AND SUBMITTED ALONG WITH OFFER)

SL. NO.	DESCRIPTION	vendor confirmation	Comments / Remarks
i.	Offer for complete package as per BHEL specification Vendors shall furnish the complete bill of material offered against the respective material codes.		
ii.	Offer for Mandatory spares as per BHEL specification. Vendor shall furnish the bill of material of mandatory spares offered.		
iii.	Clause wise confirmation / deviation to BHEL specification (as per the deviation format as per clause no 14) included in the offer.		
iv.	Reference list for ITCCS & accessories satisfying the Proven track record requirement as per clause no 16 of BHEL specification included in the offer.		
v.	Reference list for Electronic ODS satisfying the Proven track record requirement as per clause no 16 of BHEL specification included in the offer.		
vi.	Certificate of logistic support as per clause no 18 of BHEL specification included in the offer for ITCCS.		
vii.	Certificate of logistic support as per clause no 18 of BHEL specification included in the offer for ODS.		
viii.	Certificate of logistic support as per clause no 18 of BHEL specification included in the offer for ITCCS software.		
ix.	Filled in Unpriced Price schedule as per clause no 22 is included in the technical offer.		
x.	Offer for extended warranty included.		
xi.	Offer for PWAMC included.		
xii.	UNIT prices for all spare items included.		

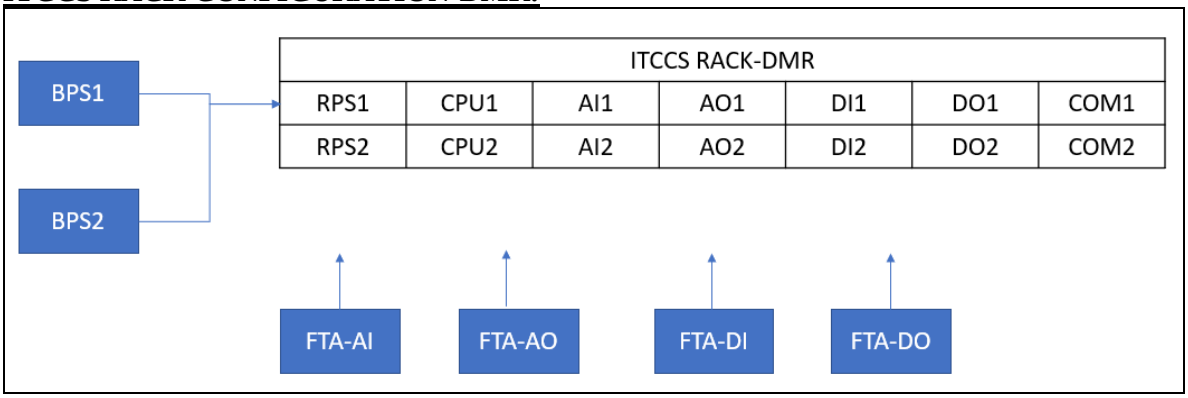
(Signature and stamp of bidder with date)

20. **SYSTEM CONFIGURATION & ARCHITECTURE**

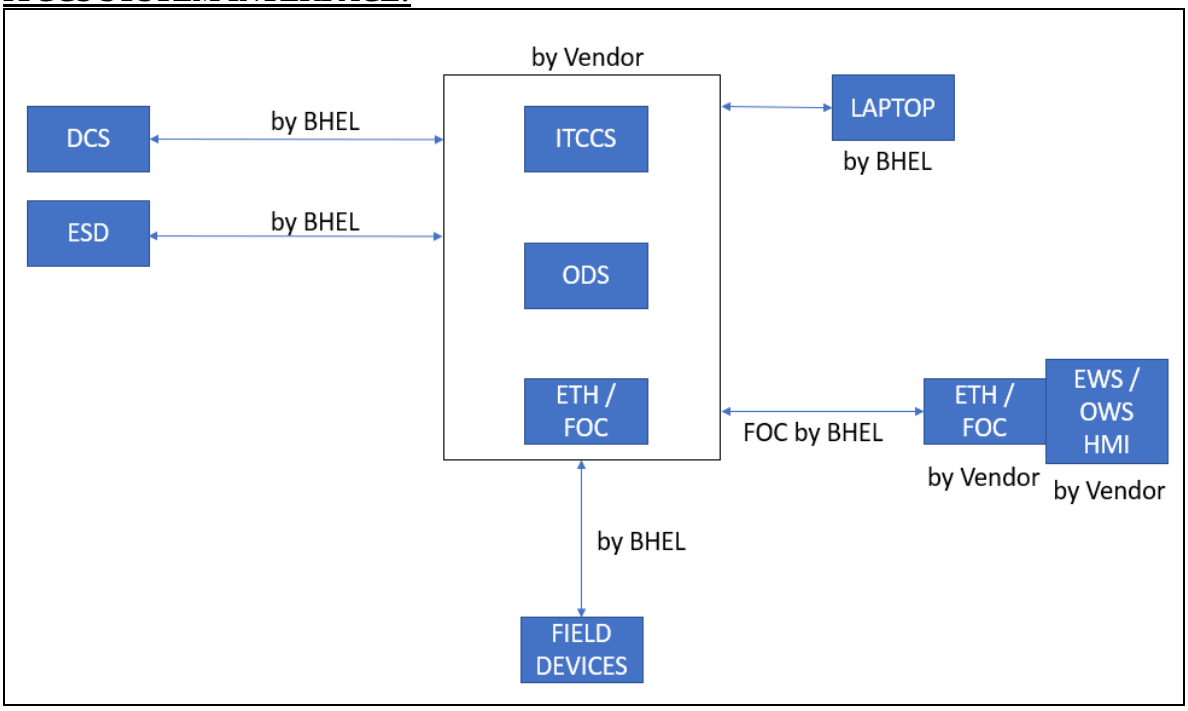
i. **ITCCS RACK CONFIGURATION-TMR:**



ii. **ITCCS RACK CONFIGURATION-DMR:**



iii. **ITCCS SYSTEM INTERFACE:**



21. **VARIANT TABLE:**

Sl No	Description of the item	RFQ Description	Material Code
i.	Magnetic speed sensor, 5/8-18 UNF threading	MAGNETIC SPEED SENSOR 5/8 THREAD	TC9765439016
ii.	TMR ITCCS & ODS package panel consisting of the following: a) ITCCS Applications: Steam Turbine Governing, Single Stage Compressor antisurge and Performance control. b) Electronic ODS for Steam Turbine. c) Auxiliary Control Application: Lube oil pump drive turbine speed control and ODS. d) Networking accessories like RS-485 Surge protectors, Ethernet switches, Fiber optic converters (single mode type), Power supply for Fiber Optic converters, connectors, patch cords, LIU etc – 1 set mounted in panel and 1 set for mounting in MCR (with EWS /OWS HMI workstation) e) Consumable spares as per 6.2-f.	TMR ITCC-1ASC+PC, OSP & LOP TURB SPD+OSP	TC9765439024
iii.	ITCCS Engineering and Operator HMI Workstation	ITCCS EWS AND OWS	TC9765439032
iv.	TMR ITCCS & ODS package- Mandatory Spares as per 6.2-e, consisting of: a) Each type of Module used like I/O cards, all types of processor cards, all types of power supply and power supply cards, communication cards, interface cards, controller cards, barrier, isolator, termination assembly etc. as required by the system – 5% of total installed quantity subject to min one number of each type. b) Networking accessories like RS-485 Surge Protectors, Ethernet switches, fiber optic converters connectors, patch cords, LIU etc. – 5% of total installed quantity subject to min one number of each type. c) Fuses of all type and rating – 100% d) Electrical items like terminals, MCB etc: 10%.	TMR ITCC & ODS SPARES-5% OR 1 NO	TC9765439040
v.	Extended warranty	As per RFQ and Price Schedule	
vi.	Pre-commissioning assistance	As per RFQ and Price Schedule	
vii.	Commissioning assistance	As per RFQ and Price Schedule	
viii.	PWCAMC	As per RFQ and Price Schedule	

22. **PRICE SCHEDULE:**

RFQ ref no. Date:
Offer ref no. Date:

a) MATERIAL SUPPLY:

Sl No	Material Description	Material Code	QTY as per RFQ	Unit Price	Total Price
1	MAGNETIC SPEED SENSOR 5/8 THREAD	TC9765439016			
2	TMR ITCC-1ASC+PC, OSP & LOP TURB SPD+OSP	TC9765439024			
3	ITCCS EWS AND OWS	TC9765439032			

b) MATERIAL SUPPLY: OPTIONAL

Sl No	Material Description	Material Code	QTY as per RFQ	Unit Price	Total Price
1	TMR ITCC & ODS SPARES-5% OR 1 NO	TC9765439040			

c) COMMISSIONING & TRAINING SERVICES:

Sl No	Service Description	Remarks	QTY as per RFQ	Price
1	Pre-Commissioning Assistance for 5 working days at site and two visits. Price shall be inclusive of Travel, boarding, lodging, and local conveyance	Lump sum		
2	Commissioning Assistance for 12 working days at site and three visits. Price shall be inclusive of Travel, boarding, lodging, and local conveyance	Lump sum		
3	Per-diem Rates for pre-commissioning and Commissioning Assistance at site. Price shall be inclusive of Travel, boarding, lodging, and local conveyance	Optional price required	Per-diem	
4	Training for 5 days at site and one visit. Price shall be inclusive of Travel, boarding, lodging, and local conveyance	Lump sum		
5	Per-diem Rates for Training. Price shall be inclusive of Travel, boarding, lodging, and local conveyance	Optional price required	Per-diem	

d) EXTENDED WARRANTY:

Sl No	Service Description	Remarks	Price
1	Extended warranty for 2 years after expiry of standard warranty (defect liability period)	1 Lot	

e) Post Warranty Comprehensive Annual Maintenance Contract (PWCAMC): OPTIONAL

Sl No	Service Description	Remarks	Price
1	First year after expiry of extended warranty	1 Lot	
2	Second year after expiry of extended warranty	1 Lot	
3	Third year after expiry of extended warranty	1 Lot	
	Total Price for 3-year PWCAMC	1 Lot	

i. Total Price in WORDS for (a+c1+c2+c4+d): ……
ii. Total Price in WORDS for OPTIONAL ITEMS (b+e): …….

Notes:

a) The prices for the spares against Mandatory spares shall be valid for one year from the date of order.
b) Please include unit prices for all spare items.
c) Any additional requirements which are essential for proper functioning of the control system, however not indicated in this specification shall be explicitly listed and included in the offer by vendor.
d) SPARES & PWCAMC is yet to be ordered by Customer. In case these are ordered by Customer, the same shall be required and considered for L1 evaluation. BHEL will inform this before commercial bid opening.

VENDOR SEAL & SIGNATURE

Ref. Doc

Ref. Doc

RECORD OF REVISIONS				
Rev. No.	Date	Revision Details	Revised By	Approved By
00	26.04.2020	First Issue	----	RAM

प्रोग्रामेबल लॉजिक कन्ट्रोलरों के लिए निरीक्षण एवं परीक्षण योजना

INSPECTION AND TEST PLAN FOR PROGRAMMABLE LOGIC CONTROLLERS

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
2	21.11.2013	Revised and Reissued	MJ	RS	SCG	SC
1	22.03.2012	Revised and Reissued	MJ	GS	AKC	DM
0	08.12.2008	Issued for implementation	RB	SKD	SKP	VC

Abbreviations

AS	:	Alloy Steel
BASEEFA	:	British Approval Service for Electrical Equipment in Flammable Atmospheres
BIS	:	Bureau of Indian Standards
CCE or CCOE	:	Chief Controller of Explosives
CEIL	:	Certification Engineers International Limited
CIMFR	:	Central Institute of Mining & Fuel Research
CE	:	Carbon Equivalent
DFT	:	Dry Film Thickness
DT	:	Destructive Testing
DP or DPT	:	Dye Penetrate Testing
ERTL	:	Electronics Regional Test Laboratory
FCRI	:	Fluid Control Research Institute
FM	:	Factory Mutual
FLP	:	Flame Proof
HART	:	Highway Addressable Remote Transducer
HV	:	High Voltage
ITP	:	Inspection and Test Plan
IP	:	Ingress Protection
IC	:	Inspection Certification
IR	:	Insulation Resistance
IEC	:	International Electro technical Commission
JEC	:	Japanese Electro technical Committee
LPT	:	Liquid Penetrate Testing
MRT	:	Mechanical Run Test
MPT/MT	:	Magnetic Particle Testing
MTC	:	Material Test Certificates
MOC	:	Material of Construction
NPSH	:	Net Positive Suction Head
NDT	:	Non Destructive Testing
NEMA	:	National Electrical Manufacturers Association
PO	:	Purchase Order
PESO	:	Petroleum Explosive Safety Organization
PQR	:	Procedure Qualification Record
PR	:	Purchase Requisition
PMI	:	Positive Material Identification
PTB	:	Physikalisch-Technische Bundesanstalt
QC	:	Quality Control
RT	:	Radiography Testing
SS	:	Stainless Steel
TC	:	Test Certificate
TPI or TPIA	:	Third Party Inspection Agency
UT	:	Ultrasonic Testing
UL	:	Under writer Laboratories
VDR	:	Vendor Data Requirement
WPS	:	Welding Procedure Specification
WPQ	:	Welders Performance Qualification
XLPE	:	Cross Linked Poly Ethylene

Inspection Standards Committee

Convenor : Mr. S C Gupta

Members:

Mr. R.K. Singh
Mr.Neeraj Mathur
Mr. Mayank Jain
Mr. Rajeev Kumar
Mr. T Kamalakannan
Mr. Himangshu Pal
Mr. Deepak Gupta (Project)

1.0 SCOPE

This Inspection and Test Plan covers the minimum inspection and testing requirements for Programmable Logic Controllers (PLC).

2.0 REFERENCE DOCUMENTS

PO/PR / Standards referred there in /Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedures**	--	--	--	--	--	--
2.0	**Material Inspection**						
2.1	Incoming Material like PLC console, power supplies, cabinets, lamps, fans, wires etc.	• Make, Model, specifications. • Operational check of components.	100%	Material Test Certificates	H	H	R
3.0	**In process Inspection**						
3.1	PLC Assembly	Visual, Dimensions, Bill of material, Wiring HV/IR	100% by Supplier	Supplier's records	-	H	R

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.2	Burn-in Test	Burn in test for 30 days	100 %	Test records	-	H	R
4.0	**Final Inspection**						
4.1	Final Inspection	• Visual Check • Dimensional check. • Bill of material. • High voltage and insulation testing • Functional testing (as per approved FAT procedure) i. Simulation of each input and output to verify proper system response ii. Complete system configuration loading check. iii. Demonstration of all PLC system builder function, generation of graphics, reports etc. iv. Sample checking of logics configured in the PLC by connecting switch/ lamp at input/output v. Check scan time vi. Check all PLC console displays, keyboard and touch-screen operation, printer function	100%	Supplier's Test Records	-	H	H

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		vii. System redundancy check as per job specification. viii. System diagnostic check for all subsystems, including checking of testing software for I/O module, signal conditioning module if specified. ix. Check output status on processor failure x. Check first-out alarm generation xi. Simulation of power failure and system restart auto boot-up of system configuration and program after power xii. Momentary power loss of 20 ms check xiii. Reversibility of polarity test xiv. Fan failure check. xv. Verification of SIL architecture and functionality, if specified.			-	H	H
4.2	Submission of certificates	• Test reports of I/O cards, controllers etc. • Degree of protection of panel boards. • SIL (Safety Integrity Level) certificate. • EM compatabilty test certificate • Environmental coating on cards, controllers as per specification.	Prototype for each model	Type Test Certificates	-	H	R
5.0	**Painting**						

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
5.1	Painting and Packing	• Visual • Protection against damage during transportation	100%	Packing list / Supplier's Records	-	H	-
6.0	**Documentation and IC**						
6.1	Documentation and IC	• Review of Internal Test Reports • Issuance of Inspection Certificate	100%	/ Supplier Test Records / IC	-	H	H
6.2	Final Document submission	Compilation of Inspection reports ,drawings, etc as per VDR / PR	100%	Final data folder /Completeness certificate	-	H	H

Legends: H- Hold (Do not proceed without approval), R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

1. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents